

What is claimed is:

1. A perpendicular magnetic recording medium comprising:
a nonmagnetic substrate; and
at least a seed layer, an orientation controlling layer, an antiferromagnetic layer, a soft magnetic layer, a magnetic recording layer, a protective layer, and a liquid lubricant layer formed on the nonmagnetic substrate,
wherein the seed layer is composed of Ta, and
wherein the orientation controlling layer is composed of a material comprising at least Ni and Fe, and at least one element selected from the group consisting of B, Nb, and Si.
2. The perpendicular magnetic recording medium according to claim 1, wherein the seed layer is formed on the substrate, in contact therewith, and the orientation controlling layer is formed on the seed layer in contact therewith.
3. The perpendicular magnetic recording medium according to claim 1, further including an exchange bias field controlling layer composed of an alloy containing at least Fe and Co, formed between the antiferromagnetic layer and the soft magnetic layer.
4. The perpendicular magnetic recording medium according to claim 1, wherein the antiferromagnetic layer is composed of an Mn alloy, and the soft magnetic layer is composed of an NiFe alloy, a sendust alloy, or an amorphous Co alloy.
5. The perpendicular magnetic recording medium according to claim 2, wherein the antiferromagnetic layer is composed of an Mn alloy, and the soft magnetic layer is composed of an NiFe alloy, a sendust alloy, or an amorphous Co alloy.
6. The perpendicular magnetic recording medium according to claim 3, wherein the antiferromagnetic layer is composed of an Mn alloy, and the soft magnetic layer is composed of an NiFe alloy, a sendust alloy, or an amorphous Co alloy.

7. The perpendicular magnetic recording medium according to claim 1, wherein the substrate is disk-shaped, and the direction of magnetization of the soft magnetic layer is the radial direction of the substrate.
8. The perpendicular magnetic recording medium according to claim 2, wherein the substrate is disk-shaped, and the direction of magnetization of the soft magnetic layer is the radial direction of the substrate.
9. The perpendicular magnetic recording medium according to claim 3, wherein the substrate is disk-shaped, and the direction of magnetization of the soft magnetic layer is the radial direction of the substrate.
10. The perpendicular magnetic recording medium according to claim 4, wherein the substrate is disk-shaped, and the direction of magnetization of the soft magnetic layer is the radial direction of the substrate.
11. The perpendicular magnetic recording medium according to claim 5, wherein the substrate is disk-shaped, and the direction of magnetization of the soft magnetic layer is the radial direction of the substrate.
12. The perpendicular magnetic recording medium according to claim 6, wherein the substrate is disk-shaped, and the direction of magnetization of the soft magnetic layer is the radial direction of the substrate.
13. A method of manufacturing a disk-shaped perpendicular magnetic recording medium comprising a nonmagnetic substrate and at least an antiferromagnetic layer, a soft magnetic layer, and a magnetic recording layer formed on the nonmagnetic substrate, the method comprising the steps of:

after depositing the antiferromagnetic layer and the soft magnetic layer, but before depositing the magnetic recording layer, heating the substrate with the thus formed layers to a blocking temperature or higher; and

cooling the substrate with the thus formed layer to the blocking temperature or below while applying a static magnetic field in a radial direction of the substrate.